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## (54) QUICK RELEASE PIPE COUPLER


(71) I, STEPHEN FRANCIS GALLAGHER, of 23 Eisenhower Drive, Norton, Massachusetts 02766, United States of America, a citizen of the United States of America, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:–


This invention relates to a quick release coupler for devices such as pipes or conduits.

Despite the large number of such devices in the prior art, a need has existed, particularly in the surgical field, for a simple coupler whereby two conduits not only may be locked together by simply inserting one part of a two part coupler into the other, but also whereby the two parts may be readily separated from each other with a minimum of motion being imparted to the coupling member connected to an object sensitive to such motion, such as a surgical patient. Also the demands for such a device require that it be simple and that each of its two parts be of a single piece construction, such as may be formed by injection moulding of plastics material.

The present invention provides a quick release pipe coupler comprising a female coupling member and a male coupling member, the female coupling member having one end thereof in the form of a continuous sleeve of resilient material provided with a pair of opposed latches projecting radially inwardly of the sleeve, the sleeve also being provided with a pair of external portions disposed diametrically opposite each other across the sleeve along a diameter perpendicular to that along which the latches are disposed and the male coupling member having a pair of diametrically opposed external locking projections extending radially outwardly thereof by a distance such that the diametrical spacing between their free end faces is greater than the diametrical spacing between the latches in the normal condition of the sleeve, whereby in the coupled position the locking projections are locked axially inwardly of the latches, wherein the portions of the sleeve intermediate the latches and said external portions have a flexibility which permits the sleeve to be sprung inwardly, upon the application of pressure to said external portions, sufficiently to move the latches radially outwardly to positions spaced diametrically apart by a distance greater than the diametrical spacing between the free end faces of the locking projections, whereby the male coupling member may be moved axially into, or out of, the female coupling member.

Advantageously, a single continuous locking flange extends round the entire circumference of the male coupling member and projects radially outwardly thereof, diametrically opposed parts of the locking flange constituting the pair of diametrically opposed locking projections.

Preferably, the wall of the sleeve is thinner between the latches and said external portions than at the latches and said external portions.

The invention will now be described in greater detail, by way of example, with reference to the accompanying drawings, in which:–

Figure 1 is a side view of the two coupling members prior to being coupled to each other;

Figure 2 is a vertical cross-section of the female coupling member of Figure 1 with the male coupling member locked in the coupled position;

Figure 3 is an end view of the arrangement of Figure 2 taken in the direction of the arrows 3–3;

Figure 4 is a view similar to that of Figure

3 showing the end ring of the female member with pressure applied to release its latches from the locking ring of the male member;

Figure 5 is a diagrammatic view of a modified shape for the latching and locking members;

Figure 6 is a view similar to that of Figure 3, showing a modification in which the male locking ring is replaced by a pair of opposed locking projections and the coupling members are keyed against rotation; and

Figure 7 is a view similar to that of Figure 1, showing a multiple conduit coupling modification.

Referring to the drawings, Figures 1 to 4 show a quick release pipe coupler which is constituted by a female coupling member 10 and a male coupling member 14. The female coupling member 10 is provided with an outer tubular member 12 which is adapted to receive a pipe or conduit 13 which can be sealed to the member 12 in any suitable manner as, for example, by cementing. The male coupling member 14 is also provided with an outer tubular member 16 which likewise receives a pipe or conduit 18. The members 10 and 14 when connected together provided a fluid-tight connection between the pipes 13 and 18. The members 10 d 14 are preferably each moulded in one piece from a mouldable plastics material such as the polymer resin Delrin.

The end of the member 10 opposite the tubular member 12 is formed as a sleeve 20 provided with two diametrically disposed latches 22 and 24 projecting inwardly and extending for a limited distance, typically about 30° around the interior of the sleeve 20. Each latch 22 and 24 has a pyramidal cross-section (see Figure 2) with an inclined outer lead surface 26 and an inclined inner locking surface 28. The wall 30 of the sleeve 20 is relatively thin so that the sleeve 20 acts as a rather stiff spring capable of being slightly flattened by applying a compressive or expansive force diametrically across the sleeve. In order to provide means for applying such a compressive force, the wall of the sleeve 20 is made with thicker sections 31 and 32, provided externally with flat finger pads 34 and 36 (see Figures 1, 3 and 4). The finger pads 34 and 36 are diametrically opposed along a diameter perpendicular to that along which the latches 22 and 24 are opposed to each other. Since the thickness of the wall of the sleeve 20 is increased at the latches 22 and 24 and at the finger pads 34 and 36, the flexibility of the sleeve is greatest at points 38, 40, 42, and 44 intermediate the latches 22 and 24 and the finger pads 34 and 36. Therefore, when a compressive force is applied across the finger paids 34 and 36, in the direction of the arrows P–P. (see Figure 4) by the fingers of the operator, maximum flexing of the sleeve 20 will occur in the vicinity of points 38, 40, 42 and 44 and the latches 22 and 24 will move outwardly in the direction of the arrows X–X (see Figure 4) as the sleeve 20 is slightly flattened by such a compressive force. Since maximum flexibility exists adjacent the points 38, 40, 42 and 44, the hinging action of the thin wall 30, during the motion of the latches 22 and 24, is also a maximum adjacent these points. The member 10 may also be provided with a pair of strain-relief slots 46 and 48 at the inner end of the sleeve 20. These slots 46 and 48, while not essential to the basic operation of the device, nevertheless provide a freer latching action of the latches 22 and 24. The relative position of the slots 46 and 48 to the latches 22 and 24 may be arranged so that they are 90 degrees apart from each other, leaving the slots 48 and 46 in-line with the finger pads 34 and 36 instead of in line with the latches 22 and 24 as shown in Figure 1 and Figure 2.

A latching and locking ring 50 is provided around the male coupling member 14 adjacent its outer end. The ring 50 is formed with an inclined lead surface 52 adapted to cooperate with the lead surface 26 of the latches 22 and 24. The ring 50 is also provided with an outer inclined locking surface 54 adapted to cooperate with the locking surface 28 of the latches 22 and 24. In order to guide the coupling member 14 properly into the coupling position within the coupling member 10 in which the desired forces are properly applied to the latches 22 and 24, the member 14 is provided with a tubular extension 56 having an outer diameter which fits snugly within a bore 58 formed within a thickened wall section 60 of the member 10. An inclined surface 62 connects the bore 58 to the smaller inner diameter of the tubular member 12. When the member 14 is initially inserted into the open end of the member 10, the extension 56 enters the righthand end of tme bore 58, thus ensuring accurate alignment of the members 14 and 10 in the subsequent locking and sealing operation.

The extension 56 will have penetrated the bore 58 for only a limited distance when the lead surface 52 of the locking ring 50 engages the lead surfaces 26 of the latches 22 and 24. As the insertion of the member 14 continues, the lead surface 52 will force the lead surfaces 26 outwardly, thus exerting an expansive pressure in the direction of the arrows X–X in Figure 4. In this way the motion of the latches 22 and 24 as described above in connection with Figure 4 will be produced. When the lead surface 52 has passed over the lead surfaces 26, the locking surfaces 28 of the latches 22 and 24 will engage the locking surface 54 of the ring 50.

The spring force stored in the sleeve 20 by the expansion force exerted on latches 22 and 24 will force the locking surfaces 28 to ride alonv the locking surface 54 and force the member 14 into its final position and lock it in that position. The member 14 is formed with an intermediate tubular portion 66 having an outer diameter somewhat larger than that of the tubular extension 56. The tubular portions 56 and 66 are joined to each other by an inclined ring portion 68, the outer surface of which will be forced into sealing engagement with the square edge of the inner end 70 of the thickened wall portion 60. In the locked position, the end face 64 of the member 56 is spaced slightly from the inclined surface 62 so as not to interfere with the sealing engagement of the members 68 and 70. As the members 10 and 14 move into the final locked and sealed position under the force exerted by the spring sleeve 20, an audible 'click' is produced giving a definite indication that the locking and sealing has been completed and that the members of the coupling are fully mated. Such locking and sealing is so secure that accidental separation of the coupled members is virtually impossible.

When it is desired to separate the coupled members, a firm compressive force is exerted on the finger pads 34 and 36, which produces the action (described above with reference to Figure 4) to release the latches 22 and 24 from the locking ring 50 whereupon the male coupling member 14 may be readily separated from the female coupling member 10. It will be noted that the maximum outer diameter of the ring 50 is substantially less than the inner diameter of the sleeve 20 in its state of maximum compression (see Figure 4) so as to permit such action to occur without the inner wall of the sleeve 20 coming into contact with the ring 50.

It will be apparent that various modifications could be made to the embodiment described above. For example, although the embodiment of Figures 1 to 4 comprises flat lead surfaces 26 for the latches 22 and 24 and a flat lead surface 52 on the ring 50, all such surfaces being inclined at substantially the same angle with respect to the axial direction through the ring 20, such surfaces may have other configurations. For example, either the lead surfaces 26 on the latches 22 and 24 or the lead surface 52 on the locking ring 50, or both, may be curved or may have angles of inclination which are not all equal. The same is true for the locking surfaces 28 and 54. The significance of the above may be better understood by referring to Figure 5, which is a diagrammatic showing of a modified cross-section of a locking ring 50*a* and a modified cross-section of a latch 24*a*. Eacx of these cross-sections presents a circular profile for the ring 50*a* and for the latch 24*a*. The tangent T to the contacting surface at their points of contact is at an angle which is inclined to the axial application of the coupling force V through the device. Thus a force C at right angles to the tangent T is exerted between the ring 50*a* and the latch 24*a*. This resolves into the vertical force V and a horizontal force H which comprises the desired expansive force to spread the latches as previously explained with reference to Figure 4. From this it will be seen that, as long as the profiles of the latches 22 and 24 and the ring 50 contact each other along a surface, either on the ring or on the latches, which surface, or the tangent to which is inclined at an angle with respect to the axial direction through the sleeve 20, the desired forces either for spreading the latches or for forcing the member 14 into its locked surface will be termed as being 'inclined' with respect to said axial direction.

In addition, instead of producing fluid-tight seals between the square edge of face 70 and the inclined surface 68, the abutting surfaces may be each flat. Also, sealing members, such as O-rings might be located between such surfaces, or between the tubular members 56 and the bore 58. Instead of the locking member of the male coupling member 14 being in the form of a ring 50, as in Figure 3, its locking function may be accomplished by the use of two separate opposing projections 72 and 74 as shown in Figure 6. In this modification the projections 72 and 74 would substantially agree with the contour of the latches 22 and 24 of the female coupling member 10. This form could be used where the coupling members 10 and 14 are keyed to each other, by a key 76 on the tubular extension 56 entering a keyway 78 formed in the inner wall of the thickened wall member 60. Such a keyed arrangement might be used where it is desired to prevent relative rotation and to maintain registration between the members 10 and 14.

The principles of this invention readily lend themselves to various types of multiple conduit couplings as shown, for example, in Figure 7. In this modification, the female coupling member 80 is provided with a plurality of bores 82, 84 etc. each of which is adapted to receive a conduti in a manner similar to that described with respect to the members 10 and 12 in Figure 3. Typically, six such bores are arranged 60° apart from each other around the axis of the member 80, although any other convenient number may be used. Latches 86 and 88, corresponding to the latches 22 and 24 of embodiment of Figures 1 to 4, are disposed on the interior of a sleeve 90, which corresponds to the sleeve 20. As in the case of the sleeve

20, the sleeve 90 is formed as a continuous sleeve with thickened and thinned wall portions to accomplish substantially the same functions as the sleeve 20. Similarly, in Figure 7, the male coupling member 92 is provided with a plurality of bore 94, 94 etc. corresponding in number and position with the bores 82, 84, etc. so that the conduits secured in the bores 82, 84 etc. may be coupled with conduits received in th bores 94, 96 etc. As in the modification of Figure 6, the male locking function is preferably performed by a pair of locking projections 98 and 100 which are adapted to cooperate with the female latches 86 and 88. In order to ensure the proper alignment of the bores 82, 84 etc. and 94, 96, etc. the female member 80 is provided with a rod 102 secured in a bore 104 formed in the base of the member 80. One side of the rod 102 carries a key 106 which is adapted to enter a keyway 108 formed in the inner wall of a bore 110 which is formed in the member 92 and which is aligned with the bore 104 in the coupled position. The bores 94, 96 etc. lead into passages 110 and 112 etc. which terminate in openings 114, 116 etc. Likewise the bores 82, 84 etc. lead into passages 118, 120 etc., which are adapted to be aligned with openings 114 116 etc. respectively. O-rings 122 and 124 set into the surfaces of member 80 surrounding passages 118, 120 etc. cooperate with the surfaces of the member 92 surrounding openings 114, 116 etc. to ensure fluid tight sealing between the aligned openings and passages. The male member 92 may be provided with a flange 126 supplied with bolt holes 128 so that it may be bolted to a bulkhead or any other convenient mounting member.

In addition to providing a sealed coupling between fluid conduits, the quick release pipe coupler of the invention may be used for any type of quick release coupler, such as for electrical couplers, where it may be desired to obtain the advantages provided by this invention. The finger pads 36 may be provided with non-slip surfaces or otherwise configured to assist in gripping the coupler. The coupling members and the devices which they connect are not necessarily circular in cross-section and therefore the terms 'tube' and 'tubular' are used herein in a general sense which includes pipes and conduits of non-circular cross-section.

WHAT I CLAIM IS:–

1. A quick release pipe coupler comprising a female coupling member and a male coupling member, the female coupling member having one end thereof in the form of a continuous sleeve of resilient material provided with a pair of opposed latches projecting radially inwardly of the sleeve, the sleeve also being provided with a pair of external portions disposed diametrically opposite each other across the sleeve along a diameter perpendicular to that along which the latches are disposed and the male coupling member having a pair of diametrically opposed external locking projections extending radially outwardly thereof by a distance such that the spacing between their free end faces is greater than the diametrical spacing between the latches in the normal condition of the sleeve, whereby in the coupled position the locking projections are locked axially inwardly of the latches, wherein the portions of the sleeve intermediate the latches and said external portions have a flexibility which permits the sleeve to be sprung inwardly upon the application of pressure to said external portions,sufficiently to move the latches radially outwardly to positions spaced diametrically apart by a distance greater than the diametrical spacing between the free end faces of the locking projections, whereby the male coupling member may be moved axially into, or out of, the female coupling member.

2. A coupler as claimed in claim 1, wherein a single continuous locking flange extends round the entire circumference of the male coupling member and projects radially outwardly thereof, diametrically opposed parts of the locking flange consituting the pair of diametrically opposed locking projections.

3. A coupler as claimed in claim 1 or claim 2, wherein the wall of the sleeve is thinner between the latches and said external portions than at the latches and said external portions.

4. A coupler as claimed in any one of claims 1 to 3, wherein the latches have lead surfaces and the locking projections are provided with lead surfaces, the lead surface of each projection being adapted to engage the lead surface of one of the leatches upon the male coupling member at least the lead surfaces of the latches or the lead surfaces of the projections being inclined with respect to the axis of the sleeve.

5. A coupler as claimed in claim 4, wherein each of the latches has a locking surface located on its side opposite its lead surface and each of the projections has a locking surface located on the side opposite its lead surface, at least the locking surfaces of the latches or the locking surfaces of the projections being inclined with respect to the axis of the sleeve.

6. A coupler as claimed in claim 4 or claim 5, wherein each of the lead surfaces is a flat surface, the flat lead surfaces all being inclined at substantially the same angle with respect to the axis of the sleeve.

7. A coupler as claimed in claim 5 or claim 6, wherein each of the locking surfaces is a flat surface, the flat locking surfaces all being inclined at substantially the same

angle with respect to the axis of the sleeve.

8. A coupler as claimed in any one of claims 1 to 7, wherein the body of the female coupling member has a thicker wall than the wall of the sleeve, the female coupling member being provided with stress-relief slots between said walls.

9. A coupler as claimed in any one of claims 4 to 8, wherein the male coupling member is provided, at its insertion end, with a tubular extension, and the female coupling member is provided with an internal bore into which the tubular extension is adapted to fit snugly, the distance between the insertion end of the tubular extension and the locking projections on the male coupling member being greater than the distance between the entrance to the internal bore and the lead surfaces mf the latches, whereby the insertion end of the tubular extension enters the internal bore before the lead surfaces on the projection come into contact with the lead surfaces on the latches.

10. A coupler as claimed in claim 9, wherein the tubular extension is adapted to make sealing contact against the mouth of the internal bore in its fully inserted position.

11. A coupler as claimed in any one of claims 1 to 10, wherein the male and female coupling members are provided with cooperating keyway means adapted to orient the coupling members so that the latches on the female coupling memberand the projections on the male coupling member are in alignent with each other in the coupled position.

12. A coupler as claimed in any one of claims 1 to 11, wherein the male and female coupling members are each provided with a plurality of openings, each opening being adapted to have an external conduit connected thereto.

13. A quick release pipe coupler substantially as hereinbefore described with reference to, and as shown in, Figures 1 to 4, Figures 1 to 4 as modified by Figure 5 or Figure 6, or Figure 7.

BROOKES & MARTIN
High Holborn House,
52/54 High Holborn,
LONDON WC1V 6SE
Agents for the Applicant

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1527332 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

FIG. 1

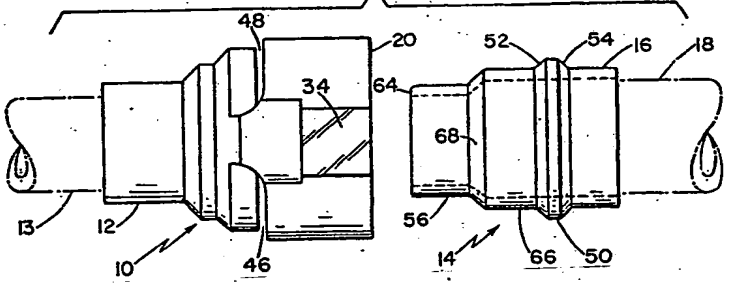
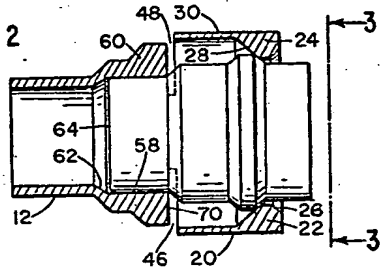



FIG. 2



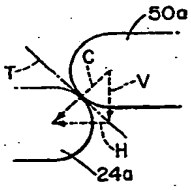




FIG. 5

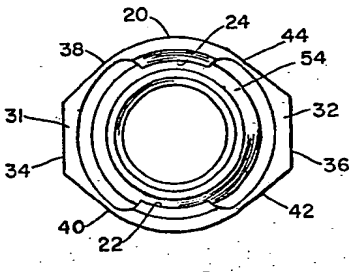



FIG. 3

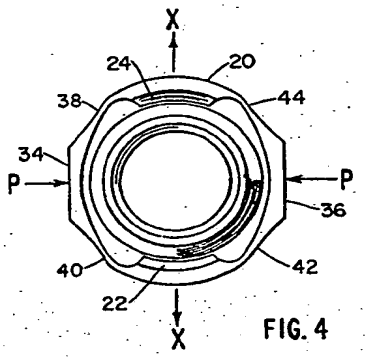



FIG. 4

1527332 COMPLETE SPECIFICATION
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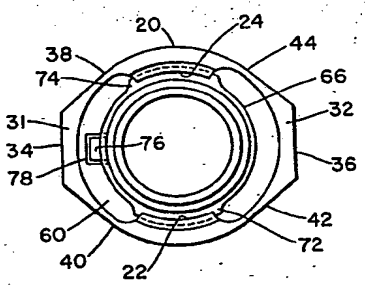
Sheet 2

FIG. 6



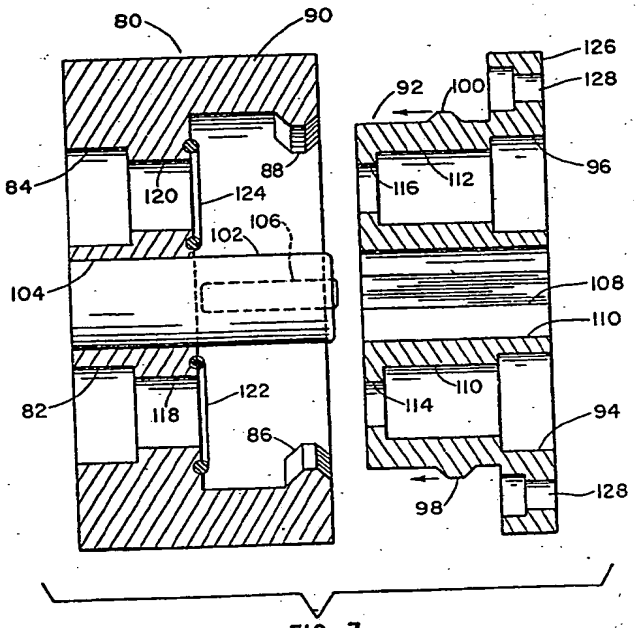




FIG. 7